

What is claimed is:

1. A method of processing an image, comprising the steps of:
 - obtaining content data about a plurality of pixels in an image;
 - grouping pixels having similar content data to form a plurality of line segments;
 - associating line segments from said plurality of line segments into at least a first window and a second window, wherein said first window and said second window represent similar pixels according to said content data; and
 - storing information pertaining to said line segments determined during said step of associating, wherein said information associates each line segment with a corresponding window.
2. The method of claim 1, further comprising the steps of:
 - reading said information stored during said step of storing; and
 - assigning a final identifier to each pixel of said plurality of pixels, such that said final identifier corresponds to said information stored during said step of storing.
3. The method of claim 1, further comprising, before the step of assigning, the steps of:
 - determining a desired output characteristic of at least said first window; and
 - incorporating said desired output characteristic in said information.
4. The method of claim 1, further comprising, after the step of assigning, the step of outputting to an output device, said image in the form of said plurality of pixels designated by said final identifiers.
- 25 5. The method of claim 1, wherein said step of grouping involves grouping pixels of only two rows of pixels at any one time.
6. The method of claim 1, wherein said step of associating involves grouping line segments by searching for a base identifier.
- 30 7. The method of claim 1, wherein said step of associating involves assigning a line segment identifier to each of said line segments.

8. The method of claim 1, wherein said step of associating involves assigning a line segment identifier to each of said line segments, wherein said line segment identifier is determined by line segment identifiers of neighboring line segments.

5

9. The method of claim 8, wherein line segment identifier is similar to line segment identifiers of neighboring line segments formed of similar pixels according to said content data.

10 10. The method of claim 9, wherein said step of storing involves a single memory location for each unique line segment identifier.

11. The method of claim 1, further comprising, after the step of storing, the step of processing said information to combine said first window and said second window into a single window if said single window would represent similar pixels according to said content data.

15 12. The method of claim 11, wherein said step of processing comprises the steps of: reading a first memory location to determine a first memory location content;

20 pointing to a further memory location corresponding to said first memory location content;

if said first memory location content does not point to said first memory location, reading a further memory location content of said further memory location;

continuing to point to succeeding memory locations until a memory location

25 content points to its own memory location and designating said memory location content as a base identifier; and

writing a base identifier to said first memory location.

13. The method of claim 1, wherein said content data is a pixel tag for each pixel of
30 said plurality of pixels.

14. The method of claim 1, wherein said image is a multiple-page document.

15. The method of claim 1, wherein said step of obtaining involves assigning an input device.

16. The method of claim 15, wherein said input device is a scanner.

5

17. A method of processing an image, comprising the steps of:

comparing a first identifier of a first line segment on a first line on said image to a second identifier of a second line segment on a second line on said image, wherein said first line and said second line are parallel to a first axis and said first line segment overlaps said second line segment along said first axis; and

10 if said first identifier does not equal said second identifier, conducting a base identifier search to determine a base identifier for said first line segment.

18. The method of processing an image of claim 17, further comprising the steps of:

15 if said first identifier does equal said second identifier, comparing said second identifier to a third identifier of a third line segment on a third line, wherein said third line is parallel to said first axis and proximate to said second line and said second line segment overlaps said third line segment along said first axis; and

20 if said second identifier does not equal said third identifier, conducting a base identifier search for said second line segment.

19. The method of processing an image of claim 17, wherein said base identifier search comprises the steps of:

25 reading a first memory location to determine a first memory location content; pointing to a further memory location corresponding to said first memory location content; if said first memory location content does not point to said first memory location, reading a further memory location content of said further memory location; continuing to point to succeeding memory locations until a memory location content points to its own memory location and designating said memory location content as a base identifier; and writing said base identifier to said first memory location.

U.S. PATENT AND TRADEMARK OFFICE

20. The method of processing an image of claim 17, wherein said first line segment and said second line segment are contiguous.
21. The method of processing an image of claim 17, wherein said first identifier is
5 stored in a first side of a ping pong memory and said second identifier is stored in a second side of a ping pong memory.
22. The method of processing an image of claim 17, wherein said image comprises a plurality of said first scan lines and a plurality of said second scan lines and each of said
10 plurality of first scan lines and said plurality of second scan lines are processed.
23. The method of processing an image of claim 17, wherein all line segments on said first scan line and all line segments on said second scan line are processed before processing line segments on a different scan line.
15
24. The method of processing an image of claim 17, wherein a first scan line of a page of said image is said first line and a last scan line of said page of said image is said second line and all remaining scan lines of said page of said image are selectively, alternatively designated as said first line and said second line during processing.
20
25. A method of processing an image, comprising the steps of:
determining a first segment tag for a first line segment on a first line parallel to a first axis;
writing a first identifier into a first memory location and assigning said first
25 identifier to said first line segment;
determining a second segment tag for a second line segment on a second line parallel and proximate to said first line wherein said second line segment overlaps a position of said first line segment along said first axis;
if said first segment tag equals said second segment tag, writing said first
30 identifier to a second memory location;
if said first segment tag does not equal said second segment tag, writing a second identifier into a second memory location and assigning said second identifier to said second line segment;

reading a first memory location to determine a first memory location content; pointing to a further memory location corresponding to said first memory location content;

if said first memory location content does not point to said first memory location,

5 reading a further memory location content of said further memory location; continuing to point to succeeding memory locations until a memory location content points to its own memory location and designating said memory location as a base identifier; and

writing said base identifier to said first memory location.

10

26. The method of processing an image of claim 25, further comprising the step of determining a location of a third line segment by identifying said third line segment on one of said first line and said second line, as contiguous with one of the group of said first line segment and said second line segment extending a lesser distance in a first

15 direction along said first axis such that said third line segment overlaps a position of the other of said group of said first line segment and said second line segment along said first axis.

27. The method of processing an image of claim 25, wherein said first line segment
20 and said second line segment are contiguous.

28. The method of processing an image of claim 25, wherein said first identifier is stored in a first side of a ping pong memory and said second identifier is stored in a second side of a ping pong memory.

25

29. The method of processing an image of claim 25, wherein all line segments on said first line and all line segments on said second line are processed before processing line segments on a different line.

30 30. An apparatus for processing an image, comprising:
a memory adapted to store at least one of the group of a first identifier of a first line segment on a first line and a second identifier of a second line segment on a second line; and

a processor coupled to said memory and adapted to compare said first identifier to said second identifier, determine a first segment tag for said first line segment, determine that said first line segment is eligible for a base identifier search if said first identifier does not equal said second identifier and conduct a base identifier search for
5 said first line segment;

wherein said first line and said second line are parallel to a first axis and said first line segment overlaps said second line segment.

31. The apparatus for processing an image of claim 30, wherein said base identifier
10 search comprises the steps of:

reading a first memory location of said memory to determine a first memory location content;

pointing to a further memory location of said memory, corresponding to said first memory location content;

15 if said first memory location content does not point to said first memory location, read a further memory location content of said further memory location;

continuing to point to succeeding memory locations of said memory until a memory location content points to its own memory location and designating said memory location as a base identifier; and

20 writing said base identifier to said first memory location.

32. The apparatus for processing an image of claim 30, wherein a first scan line of a page of said image is said first line and a last scan line of said page of said image is said second line and all remaining scan lines of said page of said image are selectively,
25 alternatively designated as said first line and said second line during processing.

33. The apparatus for processing an image of claim 30, wherein said first line segment and said second line segment are contiguous.

30 34. The apparatus of claim 30, further comprising an input device coupled to said processor to enable said processor to determine said first segment tag.

35. The method of claim 34, wherein said input device is a scanner.

36. A method for processing an image, the method comprising the steps of:
determining a pixel tag corresponding to a pixel content type of a pixel of a first
row;

5 determining a pixel identifier based on said pixel tag and pixel identifiers of
neighboring pixels in said first row and in a neighboring second row;

forming line segments of neighboring pixels of said first row having common
pixel identifiers; and

10 reviewing line segments of said second row and said first row to associate line
segments of said second row neighboring line segments of said first row and having
common pixel tags.

15 37. The method of claim 36, further comprising the step of assigning a line segment
identifier to each of said line segments, wherein said line segment identifier corresponds
to said pixel identifiers of said pixels forming each of said line segment.

20 38. The method of claim 37, further comprising the step of storing said line segment
identifiers for each of said line segments in said first row and said second row in a line
segment memory.

39. The method of claim 36, further comprising the step of forming an identifier
equivalence table to store said associations of said line segments of said second row
neighboring line segments of said first row and having common pixel tags.

25 40. The method of claim 39, further comprising the step of performing a base
identifier search to update said identifier equivalence table and associate line segments
of at least a third row.

41. The method of claim 40, further comprising the step of processing said identifier
30 equivalence table to assign window labels, wherein each window label is associated with
an area of said image having pixels of a common content type.